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ADSORPTION OF Pb IN ELECTROPLATING WASTE WATER by MORINGA SEEDS POWDER

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Abstract

One of the industries that produce liquid waste that is hazardous electroplating industry. Liquid waste generated mostly still contain high levels of metals, including metal content of lead (Pb). One way to wastewater by biosorption is a process ofadsorption by usingbiomass as an adsorbent. Moringa seeds are dried peeled and crushed with a size of 80mesh. Furthermore, moringa seed powder as much as 2 grams inserted into erlemeyer containing 100 ml of liquid waste with a specific pH, then whipped with a shaker in accordance with thevariable contact time. The filtrate obtained was analyzed. The variable in this study: wastewater pH(4,6,8,10,12) and contact time (5,15,25,35,45) minutes from the results, the best pH was at pH 4 and the contact is the best time is in 35 minutes with% removal 94.71%.

Keyword: waste water electroplating, lead, moringa seed powder.

INTRODUCTION

One of the content Of industrial waste that may cause negative impacts on the environment is a heavy metal. Pollution by heavy metals such as lead (II) can be caused by several types of industries that use materials in their production processes or compounds containing heavy metals.

Liquid waste containing lead ions (II) produced from industrial waste metal release, industry consolidation, storage batteries, as well as industrial paints and colors. Metal ions of lead poisoning on the human body will cause damage to the kidneys, reproductive system, liver, brain and even result in death

Basically the heavy metals in waste water can be separated in various ways, that is the way physics, chemistry and biology. Biological waste water treatment utilizing the ability of heavy metal accumulation in the body of the organism. The way the separation of heavy metals are widely applied as long as this is a chemical means, namely by adding chemicals, such as limestone or sodium hydroxide. While the physics of general processing done is adsorption, for example by using activated carbon and filtration using membranes

Although some of the above techniques can separate the metal in a relatively large amount, but the concentration remaining in the waste is still exceeding the concentration of metal required, in addition to these techniques require a more expensive cost. Therefore necessary to develop other ways, including use of materials - organic materials (biomaterials) is relatively more economical and easier to obtain.

As in previous studies using rice bran, which is the composition of the compound - a compound formulation, is expected to function as an ion-absorbing material - heavy metal ions. (Mawardi, 2000).

The cell walls of rice bran mainly contains protein, fat, crude fiber which contains many hydroxyl groups in its structure (Copyright and Nasution, 1979; Munaf and Zein, 1996). Non-protein nitrogen compounds in rice bran, among others, nucleotides, amines and ammonia nikotomat acid. Besides, there are also too acidic - free amino acids, namely glutamic acid, alanine and serine. (Tangenjdaja, 1991). Other components contained in rice bran is fat, minerals such as calcium, magnesium, manganese, zinc, iron, potassium and sodium.

Moringa seeds contain protein, amino acids, fiber, fat and some types of minerals such as calcium, potassium, magnesium, sodium, zinc, iron and manganese. (Muharto, Susanto H, and Daniel, 2002). And in previous studies concluded that moringa seeds can absorb (adsorption) of metal - heavy metal in water. (Puspitasari et al, 2002). In that study utilizing moringa seeds to clean water processing, and heavy metals under study are not specifically mentioned

In this study moringa seed powder is used to reduce heavy metal concentrations of Pb in the wastewater industry. With the data components contained in rice bran components idektik with moringa seed, so that in this study are used to adsorb metal moringa seeds lead.

The purpose of this study are:

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1. To reduce heavy metal concentrations of Pb in waste water effluent of electroplating industry.
2. To determine the ability of moringa seed powder as biosorben in Pb adsorb heavy metals.

With the research is expected to reduce concentrations of heavy metals Pb in electroplating waste so it does not harm the environment, other than that this method can be used as an alternative to the adsorption process in wastewater treatment for industrial purposes - the domestic industry.

The characteristics of the Moringa plant is a crooked tree, height 30-10 cm, with a headline that is not meeting. Leaf length 20-60 cm; axis segmented leaves, the gland in the form of lines or beings; fins of the first order 8-10 pairs. Child leaves stemmed, oval, oval or ovoid inverted, flat edge, the bottom side of pale green, length 1-3 cm. Long flower panicles 10-30 cm, in the armpit. Cup of green petal, petals curved canopy flipping, white, 1 cm long. Yellow and white petals, a leader of the largest, 1.5 cm length lk, other flips. Stamens and staminodia with the tip of a curved back. Hanging fruit box, angular 3, the length of 20-45 cm. Valves thick, in the middle there is mold in the former contains a row of seeds. Seeds spherical shape, with wings 3. (Van Steenis, 1977).

No	Compositions	%
1	Air	22.4
2	Protein	15.6
3	Amino acid	15.3
4	Ash	11.5
5	fat	10.1
6	Sucrose	5.5
7	Fiber	5.1
8	Starch	5.1
9	Calcium	3.76
10	L-fructose	1.5
11	Potassium	1.43
12	Magnesium	0.96
13	Sodium	0.34
14	Iron	0.086
15	Manganese	0.008
16	Zinc	0.0015
17	Copper	0.0005

Table 1. Moringa seed compositions

Source : Internet (http://www.moringaceae.com/famin)

Metals Pb (Lead) has been known to mankind since 2500 BC. This is one of the first metal known to man. Its use is very broad ranging from domestic, industrial and (first) treatment purposes

Lead in scientific language called Plumbum and symbolized by Pb. Lead found in all layers of 0.0002% of the total crust of the earth

Adsorption isotherm is an equilibrium relationship between the concentration in the fluid phase and concentration in the adsorbent particles at a given temperature. For gas, the concentration is usually expressed in mol% or pressure parts. For the liquid concentration is usually expressed in units of mass, such as parts per million (parts per million, ppm). Adsorbate concentration in solids is expressed as mass adsorbed per unit mass of adsorbent before. Langmuir isotherm stated that the gases are adsorbed on solid surfaces in the molecular layer, but in reality there are parts of the closed and open sections. The closed section will react that will determine the rate. Angapan assume that the Langmuir isotherm is used to

explain, among others:
1. Specific surface area of adsorbent.
2. Structure pores.
3. Electrolyte properties.
4. Surface acidity.

Langmuir equation is expressed as:

$$\frac{C}{x/m} = \frac{1}{a.b} + \frac{1}{a} . C$$

(Metcalf & Eddy, 1991)
with:
x = amount of adsorbate absorbed (grams).
m = weight of adsorbent (absorbing medium) used (g).
C = equilibrium concentration of adsorbate in solution after absorption / adsorption (ppm).
a, b = empirical constant.

Freundlich isothermal equation model

Freundlich isotherm is an empirical formula is often used to indicate the equilibrium concentration of solutes:

$$\frac{x}{m} = kC^{1/n}$$

(Metcalf & Eddy, 1991)
with:
x = amount of adsorbate absorbed (grams).
m = weight of adsorbent (absorbing medium) used (g).
C = equilibrium concentration of adsorbate in solution after absorption / adsorption (ppm).
k, n = constant

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RESEARCH METHOD

Materials Used in the form of electroplating wastewater with concentrations of Pb 15.630 mg / l with the use of 100 ml per each process, moringa seed powder with a size of 80 mesh with the consumption of 2 grams each process, a solution of NH4OH and HNO3 Tool Used: Shaker with a speed of 250 rpm, funnel, erlenmeyer and filter paper. Variables The Run is the pH of wastewater (4,6,8,10,12) and contact time (5,15,25,35,45) minutes.

Research Procedure

- In erlenmeyer tube insert moringa seed powder with a size of 80 mesh with a predefined size.
- Add the liquid waste into the tube erlenmeyer with different pH according to the research variables. pH was adjusted by addition of HNO3 or NH4OH solution.
- Then whipped with a shaker at a speed of 250 rpm, room temperature for different times according to the research variables.
- After a certain time-shuffled bisorbennya separated by screened.
- A separate solution timbalnya metal concentrations determined by atomic absorption spectrophotometer (AAS) flame air - acetylene at a wavelength of 283.3 nm.

RESULTS AND DISCUSSION

The results Biosorpsi Metal Lead (Pb) by using moringa seed powder in 100 ml volume of waste, pangadukan speed of 250 rpm, the weight of moringa seed powder 2 grams and initial concentration of 15.630 mg / L with the influence of contact time and pH.
The results of moringa seed powder absorption of Pb is highly dependent on contact time, where the longer the contact time, the absorption of Pb will increase or the longer the contact time, the rest of Pb will decrease. This is because the absorption of moringa seed powder is a physical process that runs slowly (takes time). The longer time means the process of absorption of the contact between moringa seed powder with a particle - the longer the metal particles so that the metal is absorbed will be greater or metal remaining in the waste will be smaller

Effect of Contact Time

Table 2. Effect of contact time at different pH on% removal

pH	Contact time	Pb consentration (mg/L)	Pb absorbed (mg/L)	% Removal
4	5	1,546	14,084	90,11
	15	1,236	14,367	91,92
	25	1,060	14,570	93,22
	35	0,827	14,803	94,71
	45	0,830	14,800	94,69
6	5	1,763	13,867	88,72
	15	1,424	14,206	90,89
	25	1,243	14,397	92,05
	35	0,955	14,675	93,89
	45	0,958	14,672	93,87
8	5	1,799	13,831	88,49
	15	1,576	14,054	89,92
	25	1,321	14,309	91,55
	35	1,108	14,522	92,91
	45	0,949	14,681	92,93
10	5	2,013	13,617	87,12
	15	1,865	13,765	88,07
	25	1,640	13,990	89,51
	35	1,286	14,344	91,77
	45	1,286	14,344	91,77
12	5	2,184	13,446	86,03
	15	2,029	13,601	87,02
	25	1,780	13,850	88,61
	35	1,410	14,220	90,98
	45	1,411	14,219	90,97

From the above data shows that the process of absorption still occurs at the contact time under 25 minutes. This is because the power is on moringa seeds are still high but after 25 minutes adsorption power generally weak, due to already saturated moringa seeds. After stirring for 35 minutes generally was not increased adsorption. This shows that after 35 minutes moringa seeds already in a state of optimum contact jenuh.Kondisi in 35 minutes at pH 4 in which the% removal reached 94.71%

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Effect of pH

Table 3. Effect of pH on a variety of contact time on% removal

Contact time	pH	Pb consentration (mg/L)	Pb absorbed (mg/L)	% Removal
5	4	1,546	14,084	90,11
	6	1,763	13,867	88,72
	8	1,799	13,831	88,49
	10	2,013	13,617	87,12
	12	2,184	13,446	86,03
15	4	2,263	14,367	91,92
	6	1,424	14,206	90,89
	8	1,576	14,054	89,92
	10	1,865	13,765	88,07
	12	2,029	13,607	87,02
25	4	1,060	14,570	93,22
	6	1,243	14,387	92,05
	8	1,321	14,309	91,55
	10	1,640	13,990	89,51
	12	1,780	13,850	88,61
35	4	0,827	14,803	94,71
	6	0,955	14,675	93,89
	8	1,108	14,522	92,91
	10	1,286	14,344	91,77
	12	1,410	14,220	90,98
45	4	0,830	14,800	94,69
	6	0,958	14,672	93,87
	8	0,949	14,681	92,93
	10	1,286	14,344	91,77
	12	1,411	14,219	90,98

Based on table 3 it can be seen that the optimum pH moringa seeds can absorb the greatest Pb at pH 4. This is because the process can be more effective biosorpsi with the presence of a specific pH and the presence of ions - ions in the media where other heavy metals can be deposited as an insoluble salt. (Suhendrayatna).

If a low pH will occur competitions heavy metal ions with hydrogen ions, so that the heavy metal ions inhibited to be absorbed by the walls biamassa, competition caused the number of hydrogen ions at low pH that prevents adsorption of metal cations on cell wall biomass. (Wallace, 2003). Whereas if the pH above 7 is not effective because at pH 6 has started happening precipitation (precipitation) and the optimum pH range between pH biosorpsi 4-5. (Zeljk Filipovic-Kovacevic, 2000).
The equation for the absorption of Pb by the metal moringa seed powder is indicated by the Langmuir isothermal equation $\left(\frac{C}{x/m}\right)$ = 0.1476 - 0.0105 with a value of constant a = 6.775, b = -14.057 and the price obtained R = 0.9999.

The equation for the absorption of Pb by the metal moringa seed powder indicated by Freundlich isothermal equation of ln $\left(\frac{x}{m}\right)$ = -0.0751 + 1.989 with a constant value n = -13.32 and k = 7.308 and R = 0.997 .

CONCLUSION

1. From the research conducted that biosorpsi process influenced by:

a. The longer the contact time the greater the absorption process that occurs so that the levels of Pb absorbed by the higher moringa seed powder until it reaches saturation point is at 35 minutes.
b. The best pH on the adsorption process of moringa seed powder to the metal Pb occurred at pH 4.

2. At the 35 minute contact time and pH 4 obtained results that moringa seed powder can absorb most of Pb is equal to 14.803% removal with 94.71%.
3. Langmuir isothermal equation most appropriately used to determine the adsorption capacity of moringa seed powder. The model equation is $\left(\frac{C}{x/m}\right)$ = 0.1476 C - 0.0105 with a value of constant a = 6.775, b = -14.057 and the price obtained R = 0.9999

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